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A Guide for Controlling the Lead Hazard Associated with Tank Entry and Cleaning

**A Supplement to
API RP 2015
Cleaning Petroleum
Storage Tanks**

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0. INTRODUCTION

The purpose of this guide is to provide information on the potential hazards and the steps to follow to prevent unnecessary exposure of personnel when entering and cleaning tanks which have been used for leaded petroleum products.

1. SCOPE AND APPLICATION

All tanks which have been used for leaded petroleum products will contain residual lead of varying concentrations. They must be regarded as dangerous to the extent that respiratory and skin protection must be used until the tank is determined to be thoroughly cleaned and safe for entry without personal protective equipment.

This guide outlines safety precautions and procedures for controlling the lead hazard associated with entry and cleaning activities in storage tanks which have contained leaded products. It does not cover specific fire prevention measures or control of other hazards not related to the lead hazard problem.

It is intended to be used with API RP 2015 *Recommended Practice for Cleaning Petroleum Storage Tanks* which contains additional information related to associated hazards. It should be regarded as a manual and not as an industrial standard.

This guide only relates to the following:

- a) The company system for lead hazard tank entry and cleaning.
- b) The check list to be followed for tank entry and cleaning as related to the lead hazard.
- c) The use of the lead-in-air analyzer.
- d) How to dispose of sludge from leaded gasoline storage tanks.

2. ORGANIZATION FOR LEAD HAZARD TANK ENTRY AND CLEANING

2.1 General

Each company should organize and maintain a system of responsibility for lead hazard tank entry and cleaning policies. Procedures should be established to provide controls within the company on tank entry and cleaning activities for the purpose of:

- a) Ensuring that only competent personnel are employed.
- b) Making certain personnel are familiar with the hazards, precautions and procedures.

2.2 Organization

Each company should have a firm, written, well-defined tank entry and cleaning policy.

Persons who have the direct responsibility to authorize the entry or cleaning of a leaded tank should know the proper tank cleaning procedures. No tank should be entered without their approval and a work entry permit.

3. CHECK LIST FOR LEAD HAZARD TANK ENTRY AND CLEANING

3.1 General

A check list which outlines safety precautions and procedures for controlling the lead hazards associated with tank entry and cleaning should be prepared. The items to be considered before, during and after a tank is cleaned should be reviewed and used as a guide by the personnel responsible for supervising safe tank entry and cleaning as well as by those who do the actual cleaning.

3.2 Check list of key points

3.2.1 Review:

- a) Company policy regarding tank entry and cleaning.
- b) Contract (if used) for cleaning work.
- c) API RP 2015 *Recommended Practice for Cleaning Petroleum Storage Tanks*.
- d) API PSD 2202 *Dismantling and Disposing of Steel from Tanks Which Have Contained Leaded Gasoline*.
- e) API PSD 2207 *Preparing Tank Bottoms for Hot Work*.
- f) ANSI Z88.2 *Practice for Respiratory Protection*.
- g) ANSI Z117.1 *Safety Requirements for Working in Tanks and Other Confined Spaces*.

3.2.2 Discuss safety precautions with supervisor

Be sure the supervisor understands and knows:

- a) The work entry permit procedure.
- b) The difference between gas free and lead hazard free.
- c) Why tank cleaners should wear proper clothing and equipment.
- d) That the ventilation of a tank must be maintained continually.
- e) That personnel must be properly trained and required to use respiratory protection equipment.
- f) The safe location of a blower type air supply:
 - 1) Upwind.
 - 2) Away from manhole.

3) Away from sludge disposal site.

g) The need for continual surveillance of men in the tank.

h) How to avoid undue exposure at manhole by men outside of tank.

i) The safe handling of sludge.

j) The requirement that men must wash before eating and smoking.

k) That men must bathe and change clothing at end of each day's work—or immediately if wet and dirty with sludge.

l) The cleanup requirements for personal protective equipment and tools.

m) The things to avoid during progress of work.

1) Removing face piece while in tank.

2) Removing gloves.

3) Twisting hose.

4) Wet sludge on clothing.

5) Blower type air supply unattended.

6) Handling of sludge and equipment removed from tank by outsiders without gloves.

7) Hoses left in tank or outside and dirty overnight.

8) Entry to tank by anyone for any purpose without protective equipment before tank is thoroughly cleaned and is lead hazard free.

9) Poor housekeeping.

3.2.3 Discuss personnel with supervisor

a) Are they sufficient in number?

b) Do they have experience?

1) Have they cleaned tanks?

2) Have they worked while wearing masks?

c) Are they in good physical condition?

d) Are they trained to use respiratory protective equipment?

3.2.4 Describe tank

a) Tank number.

b) Capacity.

c) Size.

d) Location.

e) Type roof.

f) Coated bottom or sides.

g) Location and number of manholes.

h) Date of last cleaning.

i) Tank history; types of products stored.

3.2.5 Discuss reason for cleaning

a) Repairs—note whether hot work is required.

b) Change products.

c) Routine cleaning.

d) Inspection.

e) Dismantling—note whether hot work is required.

3.2.6 Discuss sludge disposal

a) Select the method

1) Weathering.

2) Burying.

3) Other.

b) Select a site according to company rules.

3.2.7 How to prepare the tank

a) Remove all hydrocarbon possible through existing connections.

b) Remove any sources of ignition from the area.

c) Blank off all lines to tank.

d) Lock out mixer (if there is one).

e) Remove manhole cover on side and/or roof after it has been determined that vapors will disperse safely.

f) Remove balance of hydrocarbon through manhole or water draw-off.

g) Ventilate tank.

3.2.8 Arrange for tools and equipment

a) Approved pump for removing sludge and liquid from tank—check on fire and explosion-proof drive, switches, etc.

b) Shovels.

c) Brooms.

d) Scrapers.

e) Squeegees.

f) Buckets.

g) Rags or drying compound.

3.2.9 Arrange for personal protective equipment

a) Clothing (from skin out as needed for weather condition).

1) Quantity (depends on length of job and number of men used in tank and handling sludge and equipment outside of tank).

2) Clean clothes for each shift with spares to change to if needed.

3) Underwear, socks, caps and coveralls.

4) Gloves (gauntlet)—impervious to gasoline.

5) Boots—impervious to gasoline.

6) Location of shower facilities—if remote, how are personnel transported?

7) Location of cleanup facilities.

b) Air-supplied respiratory protective equipment.

1) Approved type.

2) Full face piece masks and hose, clean and in good working condition.

3) Respiratory protection for each man in tank.

4) Ample supply of breathing quality air and sufficient hose for each man to reach farthest point in tank.

5) An extra complete set of air-supplied equipment for emergency rescue use.

6) Each hose connection properly made up (tight

and washer in place).

7) Harness and safety line (when required) for each man in tank.

3.2.10 Discuss tank entry

- a) Check work entry permit procedure—be sure it is available and followed.
- b) Check to be certain gas test has been made as per API RP 2015, *Recommended Practice for Cleaning Petroleum Storage Tanks*.
- c) Check men for proper attire.
- d) Check breathing air supply.
 - 1) If blower type air supply pump is used, check wind direction and locate up wind. Check wind direction frequently and change pump location if wind direction changes.
 - 2) If air is supplied from cylinders check to make sure it is breathing quality air (do not use oxygen).
- e) Put on air mask and check for seal—note beard growth, glasses, etc.
- f) Check each man for sufficient air.
- g) Check for odor coming through mask.
- h) Check for compliance with all safety regulations.
- i) Assist men through manhole.
- j) Watch air line hose and (when used) safety line to keep free and untwisted.
- k) Assign observer and review his duties.

3.2.11 Inspect tank

- a) Wear protective attire and use air-supplied respiratory equipment.
- b) Make a thorough visual inspection.
- c) Check these four conditions:
 - 1) Has all sludge been removed?
 - 2) Have all loosely adherent material been removed from the portion of the tank that has been in direct contact with the sludge?
 - 3) Is the tank essentially dry and free of liquids?
 - 4) Be sure the tank does not contain absorbent material such as wood or concrete (see section 4.5.2).

3.2.12 Analyze lead-in-air

Be sure a qualified individual understands:

- a) The use of proper sampling procedures (see section 4).
 - 1) After tank inspection.
 - 2) The method of sampling.
- b) How to interpret results.
- c) The need to clean up lead-in-air equipment and dispose of reagent containers.

3.2.13 Clean-up

At end of day or job:

- a) Join air line hose ends to prevent interior contamination.
- b) Wash exterior of air line hose thoroughly with soap and water.
- c) Wash and sanitize face pieces.
- d) Wash and thoroughly flush sludge pump and hose.
- e) Wash all tools.
- f) Dispose of dirty water with sludge.
- g) Scrape ground around manhole and dispose with sludge.
- h) Wash boots and gloves with kerosene and then water.
- i) Shower and change clothes.
- j) Launder clothes used during tank cleaning separately (not with other clothing). Clothes wet with sludge should be rinsed in kerosene, then in soap and water before laundering with other tank cleaning clothes.

4. GUIDE FOR USE OF LEAD-IN-AIR ANALYZER

4.1 General

Before making a lead-in-air test, the tank must be cleaned, dried and ventilated in accordance with applicable provisions of API RP 2015 *Recommended Practice for Cleaning Petroleum Storage Tanks*. The use of the analyzer is a supplement to the visual inspection of the cleaned tank. It should be used only after all the necessary steps have been completed to clean the tank. At this point the analyzer is used to measure the lead-in-air concentration in the tank to determine if people can enter without respiratory protective equipment.

The person making the lead-in-air test must wear recommended attire and air-supplied respiratory equipment with a full face piece mask as prescribed in API RP 2015.

4.2 Precautions

Do not use a lead-in-air analyzer to determine if a tank has been in leaded service. A tank which has had a history of leaded service or has an unknown history since previously being declared lead hazard free will always be considered a lead hazard tank until:

- a) The tank has been cleaned and all sludge removed.
- b) Loosely adherent materials have been removed from the portion of the tank which has been in direct contact with sludge.
- c) The tank is essentially dry and free of liquids or puddles.

d) A satisfactory lead-in-air analysis has been obtained after the above three steps have been completed, showing the lead-in-air concentration to be within the prescribed limits shown in section 4.5.

Samples for lead-in-air analysis should not be taken while forced ventilation is being used, since an analysis at such time will be diluted and not reflect the most severe conditions that would be encountered during work.

Do not enter a tank for the purpose of taking a lead-in-air sample until the tank is gas-free.

4.3 Lead-in-air analyzer

The analyzer which is used to measure the concentration of lead-in-air should be capable of determining the organic lead content of the tank atmosphere.

The operating instructions to be followed when using a lead-in-air analyzer should be those recommended by the equipment manufacturer with special emphasis being given to its proper operation each time before use.

4.4 Sampling location

In order to obtain representative samples of the atmosphere within the tank, samples should be collected while operating the analyzer and walking near the inside periphery of the tank and diagonally across the tank.

Always collect at least two samples which should be in close agreement before interpreting results. If the two sample results do not agree, collect a third referee sample.

4.5 Interpretation of results

The current standard under the Occupational Safety and Health Act of 1970 (Subpart G, 1910.93; Table G-1) or as amended, limits personnel exposure to organo lead compounds to 0.075 mg/m³ (2 ug/ft³) time weighted average on any 8 hour shift in a 40 hour week. The following table can be used to determine permissible exposure times for men working in tanks without respiratory equipment provided conditions outlined above have been satisfied and the tank has been thoroughly ventilated.

Permissible Exposure Times Based on Values Given in Table G-1, 1910.93, Occupational Safety and Health Standards, 1974—0.075 mg/m³

Analyzer Results (ug/ft ³)	Time Allowed in Tank per Day
2	8 hr.
3	6 hr.
4	4 hr.
8	2 hr.

The above criteria applies to the lead hazard only and is without regard to other hazards which may be present. It must be emphasized that the tank is lead hazard free only for the conditions described above and does not apply when:

- Surfaces of the tank which have been in contact with the leaded material are to be heated above the normal temperature as with cutting, burning, welding or steaming unless all iron rust, scale or other foreign material have been removed from the areas to be heated.
- The tank contains absorbent materials which may continue to release lead.
- There is apparent evidence of a leaky bottom. If this is the case, frequent lead-in-air analysis should be made to insure safe conditions throughout the job.
- Conditions in the tank change. Should this occur, repeat lead-in-air analysis to ensure safe conditions are present.

5. DISPOSAL OF SLUDGE

5.1 General

The residue remaining in leaded gasoline storage tanks, after all recoverable gasoline has been removed, consists of a liquid phase and a solid phase. The liquid phase is primarily water and a small quantity of hydrocarbons which readily float on top of the solids. The efficient recovery of gasoline from the storage tank is necessary to minimize the amount of hydrocarbons contained in the liquid phase. This liquid phase can then be disposed of as waste water in a manner consistent with current industry practice.

The solid phase is a mixture of insoluble deposits wetted with water and hydrocarbons containing organic lead. This mixture is referred to as sludge.

5.2 Methods

Two methods are commonly used for disposing of sludge from leaded gasoline storage tanks. They are 'burying' and 'weathering.' Both methods are recognized by API RP 2015 *Recommended Practice for Cleaning Petroleum Storage Tanks*. Thermal methods are effective but not commonly used because incineration equipment is not always available.

- Burying*—In this method a pit is dug. The sludge is dumped into the pit and then covered with one to two feet of fresh earth. This area should be adequately marked so that no one inadvertently uncovers the buried sludge. Experience indicates that buried organic lead compounds decompose slowly. If a ditch or trench is dug through the sludge pit, organic lead compounds may be uncovered.
- Weathering*—This method is safe, effective and economical. Laboratory tests show that organic lead

compounds in sludge, when exposed to the elements, will decompose to inorganic lead compounds. Laboratory and field tests indicate that when the procedures, as outlined in the prescribed method are followed, there has been no air, soil or water contamination problem.

The reason for this is indicated to be:

- 1) The total quantity of organic lead in a sludge weathering bed is small. Concentrations rarely exceed the normal range of 0.1 to 0.4 pounds of organic lead per ton of sludge.
- 2) The amount of organic lead exposed to the atmosphere at the surface of the weathering bed is very small. Lead-in-air tests taken directly above or immediately downwind of the weathering bed indicate that lead-in-air concentrations are low. This indicates that the atmosphere in the area is safe from an occupational health hazard as soon as the sludge is spread.
- 3) Organic lead compounds are dissolved and held in the liquid hydrocarbon fraction of the sludge and do not migrate into the soil or ground water.

5.3 Weathering procedure

Location of disposal area:

- a) The site selected for sludge disposal should be in an area where it can be fenced off from the public. It should be located away from buildings and be far enough from the tank being cleaned so that the possibility of gasoline vapor affecting the tank cleaning operations is eliminated.
- b) The disposal area should be located so that personnel working in, on or around the tank will not walk in the spread out sludge.
- c) The disposal area can be a bare ground, grass or concrete surface.
- d) The area must be fairly smooth and well drained so that water will not stand on it.
- e) The location should be remote from streams or rivers.
- f) The total area, whether in one or several patches, must be sufficiently large to permit spreading the

sludge in a layer not over three inches thick. The total area required will be determined by the amount of sludge in the tank.

- g) It should be so located that air can circulate freely over the surface of the sludge. Exposure to the sun is desirable but not necessary.

Remove sludge from the tank in the usual manner following the safety recommendations contained in API RP 2015, *Recommended Practice for Cleaning Petroleum Storage Tanks*.

The sludge can be moved from the tank to the spreading area by wheelbarrows, buckets or other small containers. Dump trucks, lugger buckets, etc., may be used for longer distances. All containers used should be made of metal. After use, they should be washed thoroughly with water.

The sludge can be spread with hoes, rakes or shovels. It should be spread as uniformly as possible to a maximum thickness of three inches. If the area permits it, a thinner spreading is desirable. After use, hoes, rakes or shovels should be washed thoroughly with water.

Personnel handling and spreading the sludge should be dressed in protective clothing as recommended for tank cleaning. Respiratory equipment will not be necessary unless there is very little air movement (0 to 5 mph). If respiratory equipment is necessary, it can be full-face canister type (approved for organic vapors).

After the spreading is completed, the sludge patch or patches should be roped off and marked so that no one will walk through or stand in the sludge.

While sludge will normally weather within four weeks when the sludge temperature is above 0°C (32°F), lead-in-sludge tests should be made before declaring it free of the lead hazard. If after the four week weathering period the organic lead content is 20 parts per million or less (0.002 weight percent) as determined by lead-in-soil analysis, the sludge from an organic lead standpoint may then be treated as any other nontoxic industrial waste material. Signs and fences may then be removed.

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